



## Analysis of Customer Satisfaction Survey on E-Commerce Using Simple Additive Weighting Method

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**Abstract:** E-commerce is used as a transaction medium for buying and selling in digital form, providing many conveniences. The various types of e-commerce that exist make consumers confused about choosing good quality e-commerce. Therefore, this study aims to recommend determining the best e-commerce. One of the models used in this study is the SAW (Simple Additive Weighting) method because this method can provide an accurate assessment based on the criteria values and preference weights that have been determined by the authors. The SAW method can also choose the best alternative from several existing alternatives. Consideration of the use of this method is based not only on decisions made alone but also on considerations from several previous studies. The results obtained from this study using the SAW (Simple Additive Weighting) method with the highest score for customer satisfaction is Tokopedia with a value of 0,992.

**Keywords:** *e-commerce; simple additive weighting method.*

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## 1 Introduction

Indonesia is currently experiencing very rapid technological developments compared to those of several years ago. This is proven by many new innovations emerged in developing technology in Indonesia. The very rapid development of technology also affects daily activities [1]. For example, in the fields of business, health and socio-culture. Online media provide information very quickly because the need for information continues to increase. Therefore, many of us use the internet to access information from information providers [2].

One of the influences of increasingly advanced technology is in transactions in the online shopping or e-commerce business sector. E-Commerce is all activities related to transactions or trades carried out using electronic devices and internet networks and is better known as online commerce or online buying and selling [3], [4]. This activity is one of the activities never separated from daily life because the online buying and selling activities create wider opportunities for traders and buyers, starting from production requests, goods demand up to reachability not only between sub-districts but also between cities, provinces and even between countries [5].

The e-commerce system makes it easier for someone to make online transactions, but behind all the convenience gained, there are also negative things arising from e-commerce, for example, many people have bought products, but when the product reaches the buyer's hands, it does not actually match what is stated in the product information, starting from color, size, to the estimated date of delivery. So, commonly, people are now still confused about which e-commerce company is the best to minimize the worry that comes with online transactions. For that reason, a Decision Support System (DSS) is needed [6], [7]. DSS is a computer-based system that makes it easy to produce an objective decision from several alternatives and interconnected criteria [8].

It is necessary to carry out a selection using a decision support system to help speed up the selection process by algorithmic logic or appropriate methods so that the results obtained have a high level of accuracy. In this research, the selection of the best e-commerce was conducted by applying the SAW method. Based on previous studies, the SAW method has often proven useful to other researchers in completing their investigations. Using the SAW method can provide accurate assessments based on the criteria values and preference weights determined by the researchers. The SAW method can also select the best alternative from several existing alternatives because of the ranking process after determining the weights for each attribute [9], [10], [11].

In the research conducted in [12], a fuzzy logic approach was applied in determining computer specifications for a complete computer package, according to the needs of each buyer, in terms of both brand and fuzzy logic such as processor speed, hard disk capacity, memory capacity, monitor size, power supply size, and VGA size. The results of testing the system, with 10 sample users, showed an accuracy of 68%.

## 2 Research Method

This research was conducted in Semarang. The method used was Simple Additive Weighting (SAW).

### 2.1 The simple additive weighting (SAW)

The SAW (Simple Additive Weighting) method is often called the weighted sum method. The basic concept of the SAW method is to find a weighted sum of performance ratings for each alternative on all attributes. The SAW method requires the process of normalizing the decision matrix ( $x$ ) to a scale that can be compared with all existing alternative ratings [13].

$$r_{ij} \begin{cases} \frac{x_{ij}}{\text{Max } x_{ij}} & \text{if } j : \text{attribute of benefit,} \\ \frac{\text{Min } x_{ij}}{x_{ij}} & \text{if } j : \text{attribute of cost,} \end{cases} \quad (1)$$

where  $r_{ij}$  is the normalized performance rating,  $\text{Max}$  is the maximum value of each row and column,  $\text{Min}$  is the minimum of each row and column,  $x_{ij}$  are the rows and columns of a matrix.

Here,  $r_{ij}$  is the normalized performance rating of alternative  $A_i$  on attribute  $C_j$ ;  $i = 1, 2, \dots, m$  and  $j = 1, 2, \dots, n$ . The preference value for each alternative ( $V_i$ ) is given as

$$V_i = \sum_{j=1}^n w_j r_{ij}. \quad (2)$$

A larger  $V_i$  value indicates that alternative  $A_i$  is more selected.

### 2.2 The SAW method procedure

1. Determine the criteria to be used as a reference in decision making, namely  $C_i$ .
2. Determine the suitability rating of each alternative for each criterion.
3. Create a decision matrix based on criteria ( $C_i$ ), then normalize the matrix based on equations adjusted to the type of attribute.
4. The final result is obtained from the ranking process, namely the sum of the multiplication of the normalized matrix  $R$  with the weight vector, so that the largest value is selected as the best alternative ( $A_i$ ) as a solution.

## 3 Results and Discussion

### 3.1 Determining alternative

The process of determining alternatives is carried out by giving questionnaires directly to random e-commerce customers in the city of Semarang. And the results obtained are as shown in the following tables.

Table 1 shows the alternative names or e-commerce used in selecting online shopping applications.

### 3.2 Determining criteria

The criteria used in selecting e-commerce are shown in Table 2.

Alternatives	Codes
Blibli	$A_1$
Bukalapak	$A_2$
Lazada	$A_3$
Shopee	$A_4$
Tokopedia	$A_5$

**Table 1:** Alternatives.

Criteria $C_i$	Description
$C_1$	Appearance
$C_2$	Choice of product/fiture
$C_3$	Access speed
$C_4$	Service
$C_5$	Promo
$C_6$	Delivery

**Table 2:** Criteria used to select e-commerce.

Value	Rating Scale
1	Very unsatisfied
2	unsatisfied
3	Fairly satisfied
4	Satisfied
5	Very satisfied

**Table 3:** Rating scale.

### 3.3 Rating scale

The researchers provide values/rating scale for all existing alternatives. The rating scale is shown in Table 3.

Next, each criterion with its given weight is shown in Table 4.

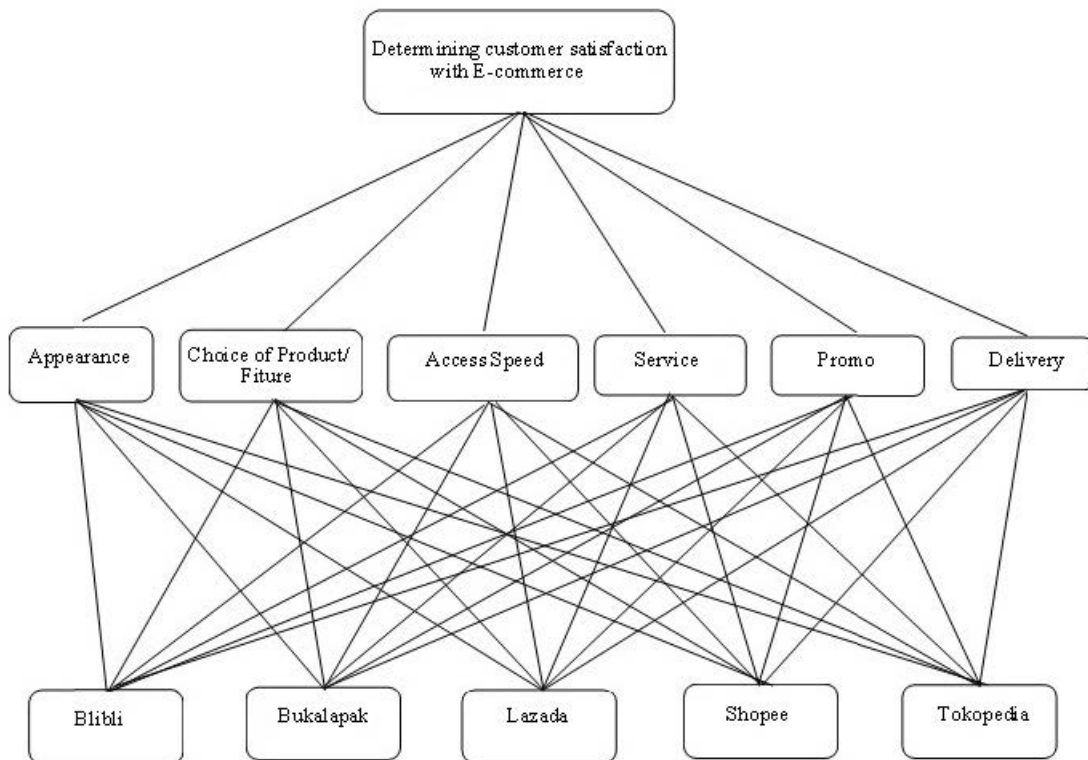
Criteria $C_i$	Description	Weight
$C_1$	Appearance	10%
$C_2$	Selected product/fitures	20%
$C_3$	Access speed	15%
$C_4$	Service	15%
$C_5$	Promo	25%
$C_6$	Delivery	15%

**Table 4:** Weight criteria.

### 3.4 Case example

Case example :

The authors will determine which e-commerce is most popular among the public using several criteria, that is, appearance, choice of products/features, speed of access, service, promos and delivery.



**Figure 1:** Hierarchy of determining the most preferred e-commerce.

### 3.5 Application of SAW method

The following are the research data used, previously summarized using Microsoft Excel software.

1. Determining the Suitability Rating.

The next step in determining the suitability rating is shown in Table 5.

2. Determining the Decision Matrix.

The next step is to form a decision matrix (x) using the suitability rating table for

Alternatives	Average Value					
	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	$C_6$
$A_1$	4.1	4	3.9	4.2	3.9	3.6
$A_2$	4.273	4.182	4.091	4	4.364	4.091
$A_3$	4.143	3.929	4.071	3.857	3.714	3.571
$A_4$	4.033	4.067	3.767	4	4.033	4.033
$A_5$	4.5	4.429	4.5	4.5	4.286	4

**Table 5:** Suitability rating.

each alternative for each criterion as follows:

$$X = \begin{pmatrix} 4.1 & 4 & 3.9 & 4.2 & 3.9 & 3.6 \\ 4.273 & 4.182 & 4.091 & 4 & 4.364 & 4.091 \\ 4.143 & 3.929 & 4.071 & 3.857 & 3.714 & 3.571 \\ 4.033 & 4.067 & 3.767 & 4 & 4.033 & 4.033 \\ 4.5 & 4.429 & 4.5 & 4.5 & 4.286 & 4 \end{pmatrix}.$$

Next, calculate the normalized value of each alternative using the method in equation (1). It should be noted that researchers here use the benefit attribute because in this research, the criteria determined refer to benefits, not costs.

**a. Appearance Criterion ( $C_1$ )**

$$r_{11} = \frac{4.1}{\max\{4.1; 4.273; 4.143; 4.033; 4.5\}} = \frac{4.1}{4.5} = 0,911,$$

$$r_{21} = \frac{4.273}{\max\{4.1; 4.273; 4.143; 4.033; 4.5\}} = \frac{4.273}{4.5} = 0.949.$$

**b. Fiture Criterion ( $C_2$ )**

$$r_{12} = \frac{4}{\max\{4; 4.182; 3.929; 4.067; 4.429\}} = \frac{4}{4.429} = 0,903,$$

$$r_{22} = \frac{4.273}{\max\{4; 4.182; 3.929; 4.067; 4.429\}} = \frac{4.182}{4.429} = 0.944.$$

**c. Access speed Criterion ( $C_3$ )**

$$r_{13} = \frac{3.9}{\max\{3.9; 4.091; 4.071; 3.767; 4.5\}} = \frac{3.9}{4.5} = 0,867,$$

$$r_{23} = \frac{4.091}{\max\{3.9; 4.091; 4.071; 3.767; 4.5\}} = \frac{4.091}{4.5} = 0.909.$$

**d. Service Criterion ( $C_4$ )**

$$r_{14} = \frac{4.2}{\max\{4.2; 4.3; 3.857; 4; 4.5\}} = \frac{4.2}{4.5} = 0,933,$$

$$r_{24} = \frac{4}{\max\{4.2; 4.3; 3.857; 4; 4.5\}} = \frac{4}{4.5} = 0.889.$$

e. Promo Criterion ( $C_5$ )

$$r_{15} = \frac{3.9}{\max\{3.9; 4.364; 3.714; 4.033; 4.286\}} = \frac{3.9}{4.364} = 0,894,$$

$$r_{25} = \frac{4.364}{\max\{3.9; 4.364; 3.714; 4.033; 4.286\}} = \frac{4.364}{4.364} = 1.$$

f. Delivery Criterion ( $C_6$ )

$$r_{16} = \frac{3.6}{\max\{3.6; 4.091; 3.571; 4.033; 4\}} = \frac{3.6}{4.091} = 0,879,$$

$$r_{26} = \frac{4.091}{\max\{3.6; 4.091; 3.571; 4.033; 4\}} = \frac{4.091}{4.091} = 1.$$

Then the normalization results are transformed into a normalization matrix, the normalization matrix for this research is as follows:

$$R = \begin{pmatrix} 0.911 & 0.903 & 0.867 & 0.933 & 0.894 & 0.879 \\ 0.949 & 0.944 & 0.909 & 0.889 & 1 & 1 \\ 0.921 & 0.887 & 0.905 & 0.857 & 0.851 & 0.873 \\ 0.896 & 0.918 & 0.837 & 0.889 & 0.924 & 0.986 \\ 1 & 1 & 1 & 1 & 0.982 & 0.978 \end{pmatrix}.$$

## 3. Ranking.

The final step is to calculate the final preference value ( $V_i$ ) obtained from the sum of the multiplication of normalized matrix row elements ( $R$ ) with preference weights ( $W$ ). The weights used are as follows:

$$W = \{0.10; 0.20; 0.15; 0.15; 0.25; 0.15\}.$$

The formula used is the formula in equation (2),

$$V_1 = (0.10)(0.911) + (0.20)(0.903) + (0.15)(0.867) + (0.15)(0.933) + (0.25)(0.894) + (0.15)(0.879) = 0.89705 \text{ (blibli)},$$

$$V_2 = (0.10)(0.949) + (0.20)(0.944) + (0.15)(0.909) + (0.15)(0.889) + (0.25)(1) + (0.15)(1) = 0.9533 \text{ (bukalapak)},$$

$$V_3 = (0.10)(0.921) + (0.20)(0.887) + (0.15)(0.905) + (0.15)(0.857) + (0.25)(0.851) + (0.15)(0.873) = 0.8775 \text{ (Lazada)},$$

$$V_4 = (0.10)(0.896) + (0.20)(0.918) + (0.15)(0.837) + (0.15)(0.889) + (0.25)(0.924) + (0.15)(0.986) = 0.911 \text{ (shopee)},$$

$$V_5 = (0.10)(1) + (0.20)(1) + (0.15)(1) + (0.15)(1) + (0.25)(0.982) + (0.15)(0.978) = 0.9922 \text{ (tokopedia)}.$$

## 4. Description of Research Data Analysis Results

Among  $V_1, V_2, V_3, V_4$  and  $V_5$ , the highest value is  $V_5 =$  Tokopedia with the result of 0,992 from the calculation using the *Simple Additive Weighting* method. It is concluded that Tokopedia is the e-commerce with the highest customer satisfaction based on predetermined criteria. Then the most satisfied criteria or services are  $C_1$  (Appearance),  $C_3$  (Service), and  $C_4$  (Access speed) with a higher average value compared to other criteria or services.

## 4 Conclusion

### 4.1 Conclusions

Based on the results of customer satisfaction survey research on e-commerce using the SAW (Simple Additive Weighting) method, several conclusions can be drawn. These conclusions are presented as follows:

1. In terms of the appearance criteria ( $C_1$ ), Tokopedia has the highest average value with a score of 4.5.
2. In terms of the product/feature choice criteria ( $C_2$ ), respondents are more satisfied with Tokopedia e-commerce.
3. In terms of the accesses speed criteria ( $C_3$ ), respondents are more satisfied with Tokopedia e-commerce.
4. In terms of the service criteria ( $C_4$ ), respondents are more satisfied with Tokopedia, Bukalapak, and Shopee e-commerces having the same scores.
5. In terms of the promo criteria ( $C_5$ ), respondents are more satisfied with Bukalapak e-commerce.
6. In terms of the delivery criteria ( $C_6$ ), respondents are more satisfied with Bukalapak e-commerce.
7. According to the data obtained by the researchers, the e-commerce with the highest value for customer satisfaction is Tokopedia with a value of 0.992.
8. The e-commerce with the lowest level of customer satisfaction is Lazada, with a value of 0.877.
9. The e-commerce most used by respondents is Shopee with 30 respondents.
10. The e-commerce least used by respondents is Blibli with 10 respondents.
11. The customer satisfaction survey ranking for e-commerce using the SAW (Simple Additive Weighting) method is from top to bottom, respectively, Tokopedia, Bukalapak, Shopee, Blibli, and Lazada.

### 4.2 Suggestions

Based on the research results, several problems were revealed, so several suggestions were made, these suggestions are as follows:

1. Insufficient number of respondents or less widespread distribution of the g-form.
2. It is suggested that respondents filling out the g-form, receive a prize for the fastest completion or it be drawn randomly after all respondents have completed the g-form.
3. The criteria specified are only a few, they should be added so that respondents can assess e-commerce in more detail.



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